

REMARKS/ARGUMENTS

Favorable reconsideration of this application in light of the following discussion is respectfully requested.

Claims 5-16, 19, 22-31 and 33-36 are presently active in this case. The present Amendment amends Claims 5-8, 10, 13-14, and 22-23; cancels Claims 1, 17-18, 20-21 and 32; and adds Claims 33-36 .

In the outstanding Office Action, Claim 32 was rejected under 35 U.S.C. § 112, first paragraph. Claims 8, 10, 11, 14-16, 18, 20 and 21 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. Claims 1, 7, 8, 10 and 11 were rejected under 35 U.S.C. § 102(b) as being anticipated by Capasso et al. (U.S. Patent No. 5,311,009). Claims 17, 18, 20 and 21 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Capasso et al. Claims 1, 7, 8, 17, 18, 20 and 21 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Tsuji et al. (U.S. Patent No. 5,471,068), in view of Takagi et al., "Design of Multi-Quantum Barrier (MQB) and Experimental Verification of MQB Effect."

In response to the rejection under 35 U.S.C. § 112, first paragraph, Claim 32 is canceled so that the rejection is now moot.

In response to the rejection under 35 U.S.C. § 112, second paragraph, Claim 8, 10, 14 were amended to depend on pending Claim 35, and Claims 18, 20 and 21 were canceled. In view of the changes to the claims, it is believed that all pending claims are definite and no further rejection on that basis is anticipated. If, however, the Examiner disagrees, the Examiner is invited to telephone the undersigned who will be happy to work with the Examiner in a joint effort to derive mutually acceptable language.

In response to the rejections of the claims under 35 U.S.C. § 102(b) and 35 U.S.C. §103(a), independent Claim 1 is canceled so that the rejections are now moot.

New independent Claim 33 is directed to a light-receiving device which converts an incident light into an electric current. The device includes an n-layer with n conduction type, a p-layer with p conduction type, and an intermediate layer. The intermediate layer includes quantum-wave interference layer units having plural periods of a pair of a first layer and a second layer, the second layer having a wider band gap than the first layer. A carrier accumulation layer is disposed between adjacent two of the quantum-wave interference layer units. Electrons and holes are excited by incident light in said carrier accumulation layer. Each thickness of the first and the second layers is determined by multiplying by an even number one fourth of quantum-wave wavelength of carriers in each of the first and the second layers. The carrier accumulation layer has a band gap narrower than that of the second layer. The p-layer is applied with a positive voltage against the n-layer and excited electrons are flowed to the p-layer and excited holes are flowed to the n-layer.

The cited prior art does teach or suggest such a combination of features. In particular, the cited prior art does not teach or suggest the device with an n-layer, a p-layer, and an intermediate layer, wherein the intermediate layer includes the claimed quantum-wave interference layer units. The Capasso patent fails to disclose the claimed quantum-wave interference layer. In particular, Capasso does not disclose a quantum-wave interference layer which has multiple layer structure and has a thickness determined by multiplying by an even number $\frac{1}{4}$ of wavelength λ of electron wave conducting in both a well layer and a barrier layer. Instead, Capasso shows a thickness determined by multiplying $\lambda/4$ by an odd number.

Furthermore, Capasso does not suggest the structure which sandwiches a carrier accumulation layer between quantum-wave interference layers. Capasso forms a multiple layer in order to reflect electrons. By contrast, the claimed quantum-wave interference layer is formed so as to facilitate the passing of electrons. Indeed, the present invention is about a light-receiving device in which voltage is applied so that a p-layer has positive electric potential toward an n-layer and incident light excites electron-hole pairs in a carrier accumulation layer. In the device of the present invention, excited electrons flow to the p-layer side and excited holes flow to the n-layer side. As shown in Applicant's Fig. 9, the claimed light-receiving device has a remarkably high sensitivity.

Even if the Capasso patent is considered to disclose the claimed quantum-wave interference layer, the cited prior art does not teach to incorporate such a structure in the i-layer of a p-i-n diode. The outstanding Office Action states that "p-i-n photodiodes were well known to those of ordinary skill in the art at the time of the invention, and it would have been obvious to have employed the Capasso wave interference structure in a p-i-n diode for the purpose of obtaining greater carrier localization in those p-i-n diodes as well, as taught by Capasso." Applicants respectfully submit that this assertion is unsupported and insufficient to establish a prima facie case of obviousness for Claim 33. Assuming arguendo that p-i-n diodes were known to those of ordinary skill in the art at the time of the invention, there is no objective evidence of record, nor specific factual findings, for a suggestion, teaching, or motivation to combine a p-i-n diode with the teachings of the Capasso.¹ In particular, nothing in the record indicates that one ordinary skill in the art would have been motivated to

¹ *In re Lee*, 277 F.3d 1338, 1342-44, 61 USPQ2d 1430, 1433-34 (Fed. Cir. 2002) (discussing the importance of relying on objective evidence and making specific factual findings with respect too the motivation to combine reference.)

increase carrier localization in a p-i-n diode by incorporating Capasso's wave interference structure in the i-layer of the p-i-n diode.

While the Capasso patent may provide a reason for incorporating its structure in an ohmic contact, the Capasso patent fails to suggest why a person of ordinary skill in the art would be motivated to incorporate such a structure in the i-layer of the p-i-n diode. The Capasso patent does not suggest that an increase in carrier localization in a p-i-n diode would be desirable. While the required evidence of motivation to combine need not come from the applied references themselves, the evidence must come from *somewhere* within the record. In this case, there is nothing in the record supporting the Office Action's proposed modification of the Capasso patent, nor of a p-i-n diode.

In rejecting a claim under 35 U.S.C. § 103(a), the USPTO must support its rejection by "substantial evidence" within the record,² and by "clear and particular" evidence³ of a suggestion, teaching, or motivation to combine the teachings of different references. As discussed above, there is no substantial evidence, nor clear and particular evidence, within the record of motivation for incorporating Capasso's structure in the i-layer of the p-i-n diode. Without such motivation and absent improper hindsight reconstruction,⁴ a person of ordinary

² In re Gartside, 203 F3d 1305, 53 USPQ2d 1769 (Fed. Cir. 2000) (holding that, consistent with the Administrative Procedure Act at 5 USC 706(e), the CAFC reviews the Board's decisions based on factfindings, such as 35 U.S.C. § 103(a) rejections, using the 'substantial evidence' standard because these decisions are confined to the factual record compiled by the Board.)

³ In re Dembiczak, 175 F3d 994, 999, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999) ("We have noted that evidence of a suggestion, teaching, or motivation to combine may flow from the prior art references themselves, the knowledge of one of ordinary skill in the art, or, in some cases, from the nature of the problem to be solved, although 'the suggestion more often comes from the teachings of the pertinent references.' The range of sources available, however, does not diminish the requirement for actual evidence. That is, the showing must be clear and particular." (emphasis added).

⁴ See MPEP 2141, stating, as one of the tenets of patent law applying to 35 USC 103, that "[t]he references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention."

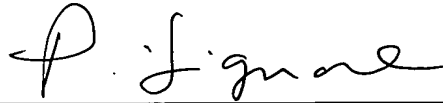
skill in the art would not be motivated to perform such modification, and Claims 5-16, 19, 22-31 and 33-36 are believed to be non-obvious and patentable over the applied prior art.

Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application, and the present application is believed to be in condition for formal Allowance. A Notice of Allowance for Claims 5-16, 19, 22-31 and 33-36 is earnestly solicited.

Should the Examiner deem that any further action is necessary to place this application in even better form for allowance, the Examiner is encouraged to contact Applicant's undersigned representative at the below listed telephone number.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



Gregory J. Maier
Attorney of Record
Registration No. 25,599

Philippe J.C. Signore, Ph.D.
Registration No. 43,922



22850

Tel: (703) 413-3000
Fax: (703) 413 -2220